

Fast motions of galaxies in the Coma I cloud: a case of Dark Attractor?

Igor D. Karachentsev

Special Astrophysical Observatory of the Russian Academy of Sciences, Nizhniy Arkhyz, Karachei-Cherkessia, 369167, Russia

Universite de Lyon, Univ. Lyon 1, CNRS/IN2P3, IPNL, Villeurbanne, France

ikar@luna.sao.ru

Olga G. Nasonova

Special Astrophysical Observatory of the Russian Academy of Sciences, Nizhniy Arkhyz, Karachei-Cherkessia, 369167, Russia

Universite de Nice - Sophia Antipolis, Observatoire de la Côte d'Azur Laboratoire Cassiopee, UMR 6202, BP-4229, 06304, Nice Cedex 4, France

phiruzi@gmail.com

Helene M. Courtois

Universite de Lyon, Univ. Lyon 1, CNRS/IN2P3/INSU, IPNL, Villeurbanne, France
IFA, Univ. Hawaii, 2680 Woodlawn Drive, HI 96822 Honolulu, USA

h.courtois@ipnl.in2p3.fr

Abstract. We notice that nearby galaxies having high negative peculiar velocities are distributed over the sky very inhomogeneously. A part of this anisotropy is caused by the “Local Velocity Anomaly”, i.e. by the bulk motion of nearby galaxies away from the Local Void. But a half of the fast-flying objects reside within a small region [$RA = 11.5^h - 13.0^h$, $Dec. = +20^\circ - +40^\circ$], known as the Coma I cloud. According to Makarov & Karachentsev (2011), this complex contains 8 groups, 5 triplets, 10 pairs and 83 single galaxies with the total mass of $4.7 \cdot 10^{13} M_\odot$.

We use 122 galaxies in the Coma I region with known distances and radial velocities $V_{LG} < 3000$ km/s to draw the Hubble relation for them. The Hubble diagram shows a Z-shape effect of infall with an amplitude of +200 km/s on the nearby side and -700 km/s on the back side. This phenomena can be understood as the galaxy infall towards a dark attractor with the mass of $\sim 2 \cdot 10^{14} M_\odot$ situated at a distance of 15 Mpc from us. The existence of large void between the Coma and Virgo clusters affects probably the Hubble flow around the Coma I also.

keywords/ galaxies: distances and redshifts — galaxies: clusters: individual (Coma I)

Accepted for publication in ApJ September, 3rd, 2011

1. Introduction

Peculiar motions of galaxies relative to the uniform Hubble expansion can be divided into two types: 1) the virial (thermal) motion in groups and clusters, and 2) coherent flows (or “Gulf Streams”) triggered by the continuing formation of the large-scale structure of the universe. In the first case the galaxies “forget” their initial conditions. Characteristic amplitudes of the virial motions amount to $\sim (70 - 700)$ km/s at the typical sizes of virial regions amounting to $\sim (0.3 - 3)$ Mpc. In the second case, the flow amplitudes can be also large, reaching ~ 700 km/s (an example — the motion of the Local Volume relative to the cosmic microwave background, CMB, with the velocity of 630 km/s (Kogut et al. 1993)). It is assumed that linear scales of the flows range from ~ 10 to ~ 200 Mpc.

In a simplified view, the cosmic currents appear as a radial infall of galaxies towards local attractors, or as radial motions outward from the centers of cosmic voids.

If the virial motions in groups and especially in clusters are easily measurable even at large distances, the cosmic flows are still mostly unstudied. The main reason is the scarcity of available database on galaxy distances.

According to Tonry et al. (2000), our Local Group and its wider vicinities are moving to the nearest Virgo cluster with a velocity of ~ 180 km/s, and to a more distant and more massive Great Attractor in the Hydra-Centaurus with a velocity of ~ 400 km/s. Some authors (Scaramella et al. 1995) explain the observed motion of the Local Volume relative to the CMB by the gravitational influence of the supercluster of galaxies, called the Shapley Concentration, located at a distance of 200 Mpc from us.

Based on much more numerous data on individual distances to nearby galaxies, Tully et al. (2008) have divided the global motion of the Local Volume into three approximately orthogonal components: the infall towards the Virgo Cluster with a velocity of 185 km/s, a recession from the expanding Local Void with 260 km/s, and a motion towards the Centaurus cluster with a velocity of 455 km/s.

According to the results of N-body simulations of the evolution of large-scale structure (Klypin et al. 2003, Schaap 2007), the pattern of collective galaxy motions on the scales of 10–100 Mpc can look much more intricate. Beyond the boundaries of virialized groups and clusters, in the regions of low density (occupying more than 90% of the universe’s volume), the characteristic kinematic pattern appears as the motion of galaxies from voids towards walls and filaments, embordering them, and as flows along the filaments to large concentrations of mass, i.e. towards the clusters. According to the results of modeling, the amplitude of such local bulk motions can reach up to several hundred km/s (see Figs. 5–7 in Klypin et al. 2003).

The data on radial velocities and distances of galaxies in the vicinity of the closest groups and clusters: the Local Group, M81 group, Centaurus A group, Virgo cluster, Fornax/Eridanus cluster reveal the presence of the expected infall zones around them (Karachentsev et al. 2007a, 2009, Karachentsev & Nasonova 2010, Nasonova et al. 2011).

Unfortunately, the study of collective galaxy motions in the low density regions is not yet supported by a sufficient amount of observational data. Only the nearest volume around us contains a reasonable number of galaxies with measured distances in order to get the initial idea on the “Gulf Streams”, associated with the walls and filaments of the large-scale structure. In our paper we attempt to assess the observational capabilities in this aspect.

2. Local ($V_{LG} < 600$ km/s) galaxies with high negative peculiar velocities

Back in the 1980s, it was noted that nearby galaxies with large negative peculiar radial velocities are distributed in the sky extremely inhomogeneously. Except for the central region of the Virgo cluster, negative velocities, $V_{pec} = V_{LG} - H_0 \cdot D < -300$ km/s, occur mainly in the region of the Gemini-Cancer-Leo constellations. This phenomenon has been called the “Local Velocity Anomaly” \equiv LVA (de Vaucouleurs & Bollinger 1979, de Vaucouleurs & Peters 1985, Giraud 1990, Hun & Mould 1990). The most plausible explanation for this phenomenon was proposed by Tully et al. (1992, 2008), under which the Local Cloud (Sheet) is receding away from the Local Void, thus approaching the neighboring clouds in the Leo and Cancer with a relative velocity of ~ 300 km/s. As a result, such galaxies as UGC3755, DDO47, KK65, D634-03, located at a distance of 7 – 9 Mpc, possess radial velocities relative to the LG of less than 200 km/s. Note that distances to these galaxies were measured with high accuracy based on the Tip of Red Giant Branch (TRGB) method with the Hubble Space Telescope (HST).

Continuing to measure distances to nearby galaxies by the TRGB method at the HST, Karachentsev et al. (2006) drew attention to other cases of galaxies with large negative peculiar velocities: IC779, KK127, NGC4150, UGC7321. These galaxies are concentrated in a small region of the sky around $12^h 10^m + 30^\circ$, where a scattered group Coma I is located.

The most representative sample of nearby galaxies to date, the Catalog of Neighboring Galaxies (Karachentsev et al. 2004), contains 450 galaxies with distance estimates within 10 Mpc from us. If the individual distance to a galaxy was unknown, it was included in the Local Volume sample based on the value of its corrected radial velocity $V_{LG} < 550$ km/s. The second, expanded version of this catalog (Karachentsev, 2012, in preparation) contains about 770 galaxies with $D \leq 10$ Mpc or $V_{LG} < 600$ km/s. Thirty-six galaxies with the velocities of $V_{LG} < 600$ km/s, but having the distance estimates exceeding 12 Mpc made it into this sample too. At the Hubble parameter $H_0 = 73$ km/s/Mpc, these galaxies have peculiar radial velocities of $V_{pec} < -276$ km/s. Their list is presented in Table 1. For the obvious reason it does not include the galaxies in the virial zone with the radius of 6° around the center of the Virgo cluster.

The columns of Table 1 contain: (1) galaxy name, (2) its equatorial coordinates, (3) morphological type on de Vaucouleurs scale; (4) radial velocity relative to the centroid of the Local Group; (5) distance estimate in Mpc; (6) the method used for distance

measurement (“tf” — based on the Tully-Fisher relation with the parameters from Tully et al. (2008), “sbf” — based on the surface brightness fluctuations from Tonry et al. (2001), “bs” — based on the luminosity of the brightest stars); (7) apparent B-band magnitude; (8) doubled amplitude of rotation in km/s; (9) peculiar radial velocity $V_{LG} - 73 \cdot D$ in km/s; (10) comments on probable galaxy membership in certain groups. Most data on magnitudes and rotational velocities are taken from NED and HyperLEDA databases and supplemented with Courtois et al. (2009, 2011) and Cannon et al. (2011).

Figure 1 shows the distribution of 8811 galaxies in the sky in equatorial coordinates with radial velocities $V_{LG} < 3000$ km/s at the galactic latitudes $|b| > 15^\circ$. The gray ragged strip indicates the zone of strong galactic absorption according to Schlegel et al. (1998). The figure clearly shows the filamentary structure of the Local Supercluster and its immediate environs. The red circles mark 36 galaxies from Table 1 with large negative V_{pec} . The distribution of the 36 marked galaxies is characterized by a significant clumpiness, as well as by the west-east asymmetry. A part of this asymmetry is caused by the LVA phenomenon, caused by the runaway of galaxies from a large volume of the Local Void centered approximately at $[19.0^h, +3^\circ]$. The median peculiar velocity of the “flyer” galaxies is 660 km/s. With a median distance of the galaxies amounting to 15.1 Mpc, a typical error of distance measurement using the Tully-Fisher method (about 20%) generates a characteristic error of peculiar velocity amounting to ~ 220 km/s. Consequently, some galaxies could appear in Table 1 due to the distance measurement errors. Another reason could be the entry of galaxies in a group or a cluster with large virial velocities. Some cases like this are commented in the last column of Table 1. In particular, the case of an E-galaxy NGC1400, belonging to the Eridanus group, was already discussed by Trentham et al. (2006). Curiously, this list includes the galaxy UGC12713 = LOG506, which is included in the catalog of 513 most isolated objects of the Local Supercluster (Karachentsev et al. 2011).

Exactly one half of the galaxies in Table 1 is concentrated within the region $RA = [11.5^h, 13.0^h]$, $Dec. [+20^\circ, +40^\circ]$, occupying only 1% of the total area of the sky. The probability of random formation of such a configuration is vanishingly small ($\sim 10^{-30}$). This subsystem of “flyers”, designated in Table 1 as Coma I cloud, is characterized by the median distance of 16.2 Mpc and the median peculiar velocity of -740 km/s. A complex kinematic situation in this region, which lies on the equator of the Local Supercluster, deserves a more detailed examination.

3. The Coma I complex of galaxies

According to Tully (1988) in the region $RA = [11.5^h, 13.0^h]$, $Dec. = [+20^\circ, +40^\circ]$, outlined by a red contour in Fig. 1, there is a group of galaxies “14–1”, belonging to the Coma-Sculptor cloud. From 25 galaxies with known radial velocities Tully has determined the mean radial velocity of the group as $+911$ km/s and its total luminosity of $L_B = 1 \cdot 10^{11} L_\odot$. The virial radius of the group according to Tully is 0.34 Mpc, the

dispersion of radial velocities $\sigma_v = 266$ km/s and the ratio of virial mass to luminosity $M_{VIR}/L_B = 523M_\odot/L_\odot$.

At present, 206 galaxies are known in this region with radial velocities $V_{LG} < 3000$ km/s. The distribution of these galaxies on the velocity scale is shown in Fig. 2. The early-type galaxies with developed bulges ($T < 3$) are marked in gray. A small number of galaxies with radial velocities $V_{LG} > 1200$ km/s catches one's eye. This is probably due to the presence of a large cosmic void between the Local Supercluster and the rich Coma cluster (+6900 km/s).

Some authors made a search for dwarf galaxies in the region of Coma I. Almost a half of this region has been inspected by Binggeli et al. (1990) on the specially exposed IIIaJ Palomar Schmidt plates, resulting in to the discovery of 34 dwarf galaxies. Trentham & Tully (2002) used the 8-m Subaru telescope to search for the dwarf population in Coma I in a narrow strip near NGC4274. In the area of 1.3 square degrees, they have detected about 30 dwarf member candidates of the Coma I group. Karachentsev et al. (2007b) found in the region $RA = [11.5^h, 13.0^h]$, $Dec. = [+20^\circ, +40^\circ]$ twenty-five dwarf galaxies of low surface brightness. Subsequent observations in the HI 21cm line (Huchtmeier et al. 2009) added several new dwarf members of the Coma I complex. About 12% of the studied region overlap with the zone of the blind HI survey (Kovac et al. 2009), where several new nearby gas-rich dwarfs were discovered. The SDSS survey contains a lot of valuable data about the galaxies in Coma I (Abazajian et al. 2009). Boselli & Gavazzi (2009) used the HI characteristics of the galaxies in this region to search for the effect of "HI-deficiency".

Makarov & Karachentsev (2011) collected the observational data on 10 800 galaxies in the Local Supercluster and its vicinity with $V_{LG} < 3500$ km/s and $|b| > 15^\circ$. A new clustering algorithm was applied to this sample, which takes into account individual luminosities, radial velocities and mutual distances of galaxies. In contrast to the simple friend-of-friend percolation algorithm (Huchra & Geller 1982, Crook et al. 2007), a new criterion isolates the galaxy systems with approximately the same characteristics both in close and distant volumes. In the examined region $RA = [11.5^h, 13.0^h]$, $Dec. = [+20^\circ, +40^\circ]$ eight groups (Makarov & Karachentsev 2011), 5 triplets (Makarov & Karachentsev 2009) and 10 pairs of galaxies (Karachentsev & Makarov 2008) were isolated with a total of $n_v = 122$ members. Apart from them, 83 galaxies have evaded the clustering, representing 41% of the total. The data on the group members, the members of triplets and pairs, and single galaxies are listed in Tables 2, 3 and 4, respectively. The columns of tables contain: (1) galaxy name, (2) its coordinates, (3) radial velocity relative to the LG, (4) morphological type, (5) the apparent K_s -magnitude, (6,7) the distance to the galaxy, indicating the method of distance measurement: "cep" — from the luminosity of Cepheids, "rgb" — from the luminosity of the tip of red giant branch, "sbf" — from the surface brightness fluctuations, "tf" — by the Tully-Fisher method. The assumed typical errors of these methods are: 7% for "cep" and "rgb", 12% for "sbf", and 20% for "tf".

The distribution of 206 galaxies of different degrees of multiplicity is presented in equatorial coordinates in Fig. 3. Early-type galaxies ($T < 3$) are marked in gray. The members of the eight groups are indicated by squares, the members of triplets and pairs — by triangles, and single objects are shown by small circles. The larger symbols mark bright galaxies with $m_K < 8.0^m$. Note that among 83 field galaxies there are only two early-type galaxies: CGCG186-009 and UGC7816, and objects of high luminosity are almost absent.

As we can see, there exists a mutual overlap of members of different systems in this sky region. However, this situation is absolutely expectable, since the region is located on the very equator of the Local Supercluster.

The summary of the main characteristics of the eight MK-groups, forming the Coma I complex is presented in Table 5, its columns contain: (1) the name of the brightest galaxy of the group, (2) the number of members with measured radial velocities, (3) the mean radial velocity based on which the distance to the group was determined at $H_0 = 73$ km/s/Mpc, (4) radial velocity dispersion, (5) linear harmonic radius of the group in kpc, (6) the total luminosity of the group members in the K_s -band, (7,8) virial mass and virial mass ratio to the total K-luminosity, (9) the number of group members with measured distances, (10,11) the mean distance modulus of the group and its variance. In the lower rows of columns (5–8) we list the values of group parameters, not derived by the average velocity of the group, but from the average of individual distance moduli of the group members.

It follows from these data that the groups of galaxies have a typical linear size of ~ 300 kpc and a rather low dispersion of radial velocities. Only one group, NGC4150, stands out by a very high virial mass-to-luminosity ratio, $M_{VIR}/L_K = 830M_\odot/L_\odot$. However, this value drops by a factor of 5 when the distance to the group is estimated directly, rather than by the mean radial velocity.

Most of the individual distance moduli for galaxies in this complex were measured from the Tully-Fisher relation with a typical error of ~ 0.4 mag. The values of $\sigma(DM)$ in the last column of Table 5 show that 7 out of 8 groups may be regarded as real physical groups. Only in the case of group NGC4631 the applied clustering algorithm isolates a pseudo-group of galaxies with close radial velocities, but different distance estimates (subgroups around NGC4631, NGC4278 and NGC4414). Despite the small statistics, a good agreement between the distance estimates is as well observed in the pairs and triplets of galaxies (see Table 3).

4. Hubble flow in the Coma I complex

A group of galaxies around NGC 4150 looks like a “flock” heading towards us with an average velocity of -1002 km/s relative to the uniform Hubble expansion. Its angular distance from the center of the Virgo cluster is 17° , what is smaller than the zero-velocity surface radius of the cluster, 23° (Karachensev & Nasonova 2010). At the first

sight, a high peculiar velocity of NGC4150 can be explained by its participation in the Virgocentric infall. However, the group is located at a distance of 16.3 Mpc from us, almost as far as the center of the Virgo cluster (16.8 Mpc). Therefore, the radial infall of the NGC4150 group toward the center of the cluster should not produce a significant component of the line-of-sight velocity. Consequently, there exists another reason of high peculiar velocity in this group as a whole.

The distribution of 122 galaxies in the Coma I region by radial velocities and distance estimates is presented in Fig. 4. Its upper and lower pannels show the same observational data but given in two different manner: in the linear scale and in a log-log view. Different symbols denote galaxies of different morphology and membership in the same manner as in Fig.3. Distance error bars are marked by light horizontal lines. The straight line there corresponds to the uniform Hubble flow with the parameter of $H_0 = 73$ km/s/Mpc. The broken line shows the behavior of the running median with a window of 2 Mpc. Notwithstanding a significant scatter of observational data, the mean radial velocity variation with distance demonstrates the well-known effect of a Z-shaped wave that results from the infall of galaxies towards a local attractor. The characteristic infall velocity at the front side is about 200 km/s, and at the back side it amounts to about 700 km/s. Two dashed lines in Fig. 4 show the order of infall on the attractor with the mass of $0.5 \cdot 10^{14}$ and $2.0 \cdot 10^{14} M_\odot$, located at a distance of 15 Mpc from us, for the line of sight, crossing the center of the attractor. A comparison of these curves with the running median suggests that the mass of the hypothetical attractor is $\sim 2 \cdot 10^{14} M_\odot$.

However, the distribution of galaxies in Fig. 1 does not reveal any prominent concentration of galaxies in the region of Coma I. In other words, what we have here is an unusual case of a Dark Attractor. The total virial mass of 8 groups from Table 5 is $3.5 \cdot 10^{13} M_\odot$. Adding to it the total mass of five triplets ($0.3 \cdot 10^{13} M_\odot$), 10 pairs ($0.2 \cdot 10^{13} M_\odot$) and single galaxies ($\sim 0.7 \cdot 10^{13} M_\odot$), we derive the total mass of the Coma I complex of about ($4.7 \cdot 10^{13} M_\odot$). This value is four times smaller than the expected mass to explain the infall amplitude in Fig. 4.

As noted by Makarov & Karachentsev (2011), the total mass of the dark matter concentrated in the virial regions of groups and clusters corresponds to the average density $\Omega_m = 0.08 \pm 0.02$, which is three times lower than the global density of 0.28 ± 0.03 (Spergel et al. 2007). An assumption that 2/3 of the amount of dark matter in the universe is located outside the virialized regions can be one of the explanations of this contradiction. Massive, but unvirialized filaments and walls of the large-scale structure may appear to be considerable reservoirs of dark matter as well as “lost” baryons (Fukugita & Peebles 2004). It is quite likely that the region of Coma I is a fragment of such a massive dark filament, extending far to the north of the Virgo cluster.

5. Concluding remarks

The detection of galaxies or galaxy groups, moving with peculiar velocities of $\sim (500 - 1000)$ km/s is a sophisticated observational task. Such motions in the low density regions, comparable in amplitude with virial velocities in clusters, probably arise from the continuing formation of elements of the large-scale structure, namely, filaments and walls.

Large peculiar motions in the Coma I cloud are not related with a high concentration of galaxies in this field. The observed relationship between the velocities and distances in the Coma I resembles the pattern of galaxy infall towards an invisible Dark Attractor. Such an attractor can be a dark filament (~ 200 galaxies + dark matter), which extends to the north of the Virgo cluster. Behind this filament there is a large cosmic void, lying between the Virgo and Coma I clusters. It is possible that the presence of this void causes the three times greater infall amplitude at the far side of the filament in the Coma I compared to the front side. The observational resources for the investigations of motions in Coma I are far from being exhausted. The scatter of galaxies on the Hubble diagram (Fig. 4) is partly due to the low quality of the available HI data, used to determine the distances by the Tully-Fisher method. For example, according to the LEDA, the galaxy IC2992=Mrk757 has the HI line width of $W_{50} = 138$ km/s, whereas according to the recent observations at the Arecibo, it amounts to only 46 km/s (R. Giovanelli, personal communication). Within the SDSS survey (Abazajian et al. 2009) a large number of dwarf galaxies were detected in Coma I, in which the HI line widths have not yet been measured. Almost entire region of the Coma I is situated in the ALFALFA survey zone (Giovanelli et al. 2005). New data from this survey can render the pattern of kinematics in the Coma I galaxies much more clear ‡.

One pessimistic deduction follows from the above. For the vast majority of galaxies the only distance estimates available as yet are their radial velocities. To account for non-Hubble motions of galaxies, and thereby improve the accuracy of kinematic distance measurement V/H_0 , various models correcting for the local galaxy infall towards the Virgo attractor and the Great Attractor in the Centaurus have been proposed (Kraan-Korteweg 1986, Masters 2005). Such models may, however, turn out to be too naive, not reflecting the true pattern of large-scale flows.

Acknowledgments

I.D. Karachentsev thanks Riccardo Giovanelli for the provision of the ALFALFA data prior to publication. This work was partially supported by the following grants: the Russian Foundation for Basic Research (grant no. 11-02-00639), the CNRS, a grant from

‡ The new ALFALFA data release (Haynes et al, arXiv:1109.0027) yields at least two new distant dIr galaxies with low velocities in the Coma I field: AGC229053 ($D = 17.9$ Mpc, $V_{LG} = +376$ km/s) and AGC749236 ($D = 19.5$ Mpc, $V_{LG} = +235$ km/s).

the Space Telescope Science Institute under the NASA contract within GO12546, a grant of the Ministry of Education and Science of the Russian Federation N 14.740.11.0901. O.G. Nasonova thanks the non-profit Dmitry Zimin's Dynasty Foundation for the financial support.

References

- Abazajian K.N., Adelman-McCarthy J.K., Agueros M.A. et al., 2009, *ApJSuppl.* 182, 543
 Binggeli B., Tarenghi M., Sandage A., 1990, *A & A*, 228, 42
 Boselli A., Gavazzi G., 2009, *A & A*, 508, 210
 Cannon J.M., Giovanelli R., Haynes M.P. et al., 2011, *ApJL*, in press (arXiv:1105.4505)
 Courtois H.M., Tully R.B., Makarov D.I. et al., 2011, *MNRAS*, 411, 2005
 Courtois H.M., Tully R.B., Fisher J.R. et al., 2009, *AJ*, 138, 1938
 Crook A.C., Huchra J.P., Martimbeau N. et al., 2007, *ApJ*, 655, 790
 de Vaucouleurs G., Peters W.L., 1985, *ApJ*, 297, 27
 de Vaucouleurs G., Bollinger G., 1979, *ApJ*, 233, 433
 Fukugita M., Peebles P.J.E., 2004, *ApJ*, 616, 643
 Giovanelli R., Haynes M.P., Kent B.R., et al. 2005, *AJ*, 130, 2598
 Giraud E., 1990, *A&A*, 231, 1
 Han M., Mould J., 1990, *ApJ*, 360, 448
 Huchra J.P., Geller M.J., 1982, *ApJ*, 257, 423
 Huchtmeier W.K., Karachentsev I.D., Karachentseva V.E., 2009, *A & A*, 506, 677
 Karachentsev I.D., Makarov D.I., Karachentseva V.E., Melnyk O.V., 2011, *Astrophys. Bulletin*, 66, 1
 Karachentsev I.D., Nasonova O.G., 2010, *MNRAS*, 405, 1075
 Karachentsev I.D., Kashibadze O.G., Makarov D.I., Tully R.B., 2009, *MNRAS*, 393, 1265
 Karachentsev I.D., Makarov D.I., 2008, *Astrophys. Bulletin*, 63, 299
 Karachentsev I.D., Karachentseva V.E., Huchtmeier W.K., 2007a, *Astron.Lett.*, 33, 512
 Karachentsev I.D., Tully R.B., Dolphin A. et al. 2007b, *AJ*, 133, 504
 Karachentsev I.D., Dolphin A.E., Tully R.B., et al. 2006, *AJ*, 131, 1361
 Karachentsev I.D., Karachentseva V.E., Huchtmeier W.K., Makarov D.I., 2004, *AJ*, 127, 2031 (CNG)
 Klypin A., Hoffman Y., Kravtsov A.V., Gottloeber S., 2003, *ApJ*, 596, 19
 Kogut A., Lineweaver C., Smoot G.F., et al., 1993, *ApJ*, 419, 1
 Kovac K., Oosterloo T.A., van der Hulst J.M., 2009, *MNRAS*, 400, 743
 Kraan-Korteweg R.C., 1986, *A & AS*, 66, 255
 Makarov D.I., Karachentsev I.D., 2011, *MNRAS*, 412, 2498
 Makarov D.I., Karachentsev I.D., 2009, *Astrophys. Bulletin*, 64, 24
 Masters K.L., 2005, "Galaxy flows in and around the Local Supercluster"q, PhD, Cornell Univ.
 Nasonova O.G., de Freitas Pacheco J.A., Karachentsev I.D., 2011, *A&A*, 532, A104
 Scaramella R., 1995, *ApL & C*, 32, 297
 Schaap W., 2007, PhD Thesis, Groningen Univ.
 Schlegel D.J., Finkbeiner D.P., Davis, M., 1998, *ApJ*, 500, 525
 Spergel D.N., et al. 2007, *ApJS*, 170, 377
 Tonry J.L., Dressler A., Blakeslee J.P., et al. 2001, *ApJ*, 546, 681
 Tonry J.L., Blakeslee J.P., Ajhar E.A., Dressler A., 2000, *ApJ*, 530, 625
 Trentham N., Tully R.B., Mahdavi A., 2006, *MNRAS*, 369, 1375
 Trentham N., Tully R.B., 2002, *MNRAS*, 335, 712
 Tully R.B., Shaya E.J., Karachentsev I.D., et al., 2008, *ApJ*, 676, 184
 Tully R.B., Pierce M.J., 2000, *ApJ*, 533, 744

Tully R.B., Shaya E.J., Pierce M.J., 1992, ApJS, 80, 479

Tully R.B., 1988, Nearby Galaxies Catalog, Cambridge University Press

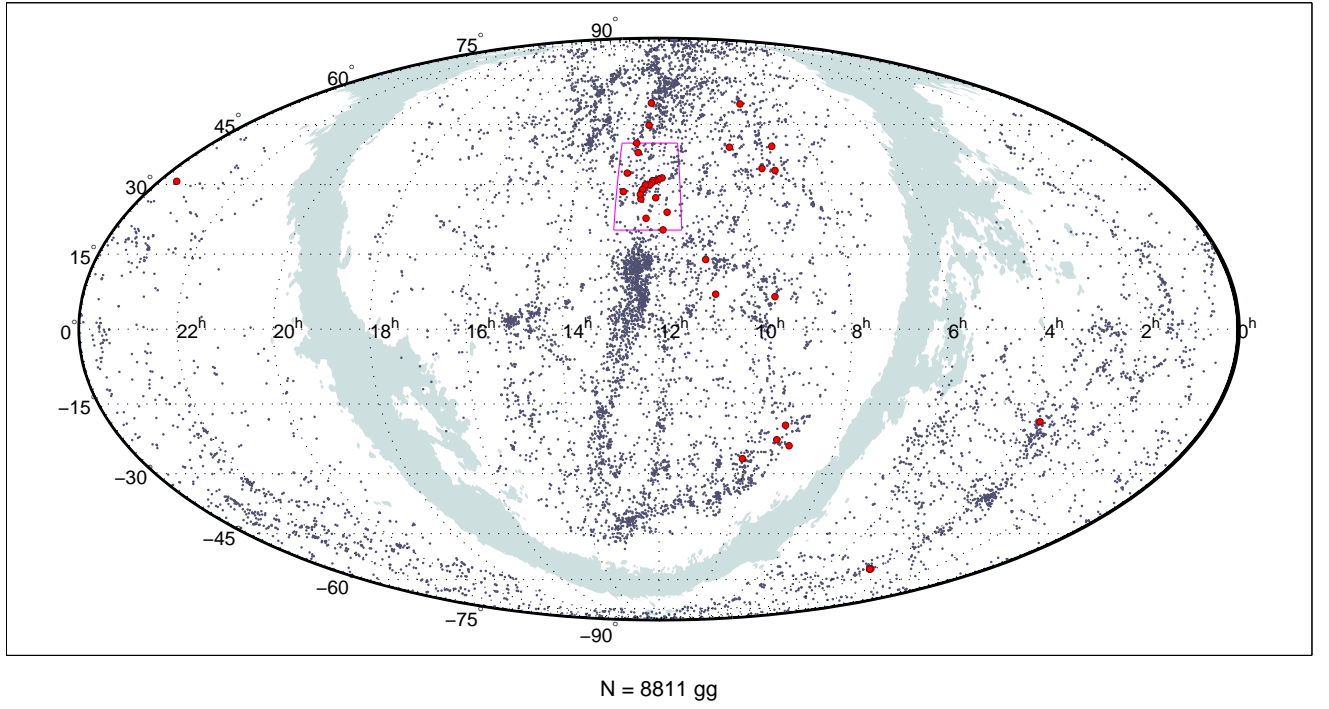


Figure 1. The distribution of 8811 galaxies (marked with points) with radial velocities of $V_{LG} < 3000$ km/s in the sky in equatorial coordinates. The circles mark the galaxies with large negative peculiar velocities. A half of them is concentrated in the Coma I region inside the rectangular contour. The region of strong absorption along the Milky Way is filled in gray.

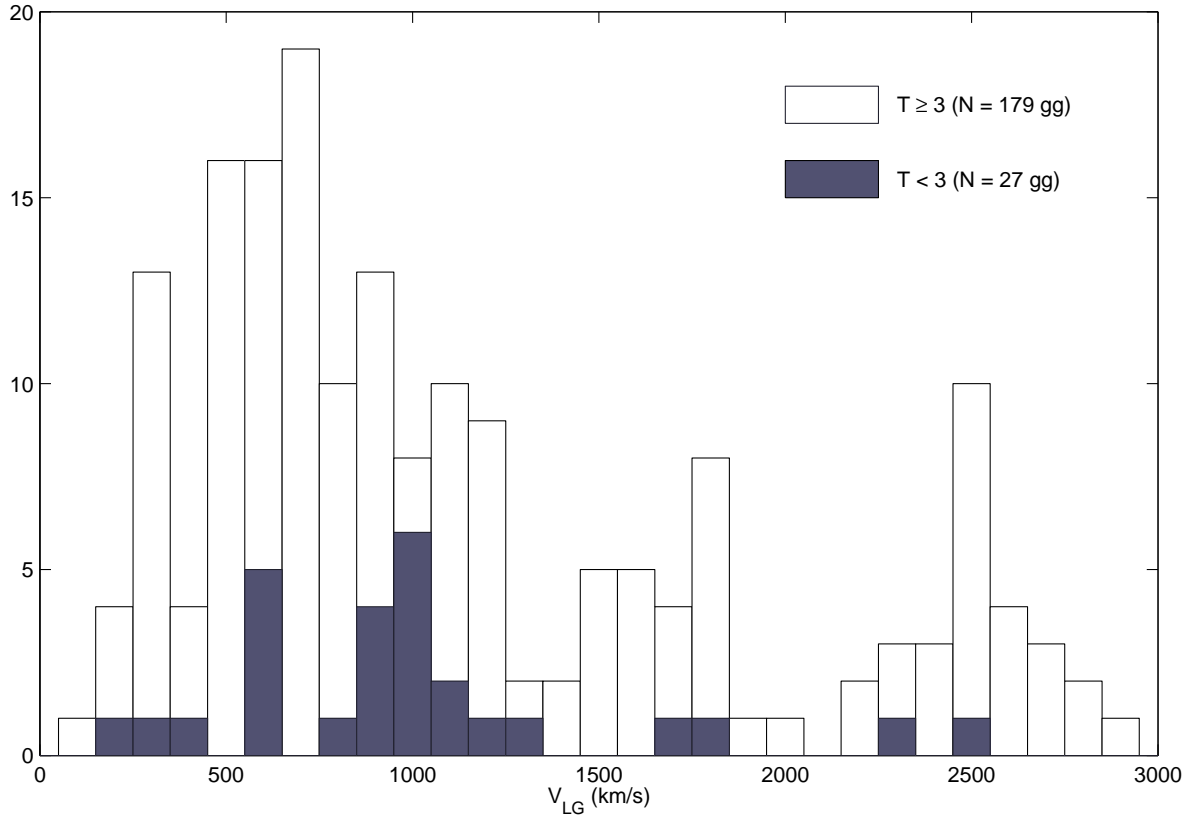


Figure 2. The distribution of 206 galaxies in the Coma I cloud by radial velocities. The early-type galaxies of $T < 3$ are shaded.

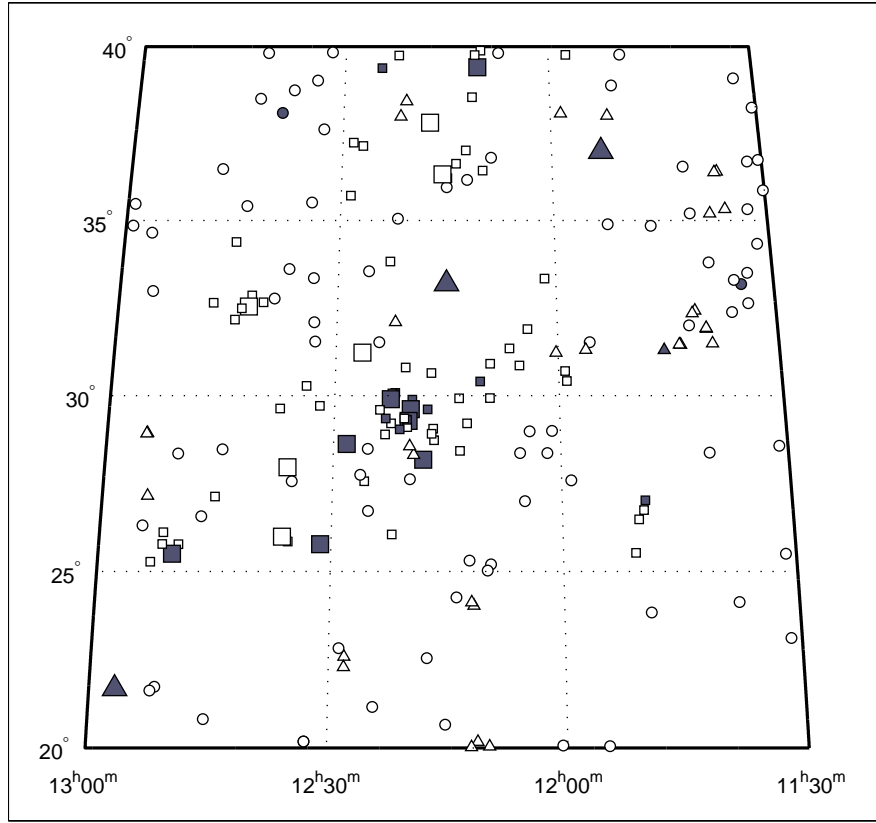


Figure 3. The distribution of 206 galaxies in the Coma I region on a larger scale. The squares mark the group members, the triangles — the members of triplets and pairs, the circles — single galaxies. The galaxies with bulges ($T < 3$) are shown in gray. Eighteen brightest galaxies with $m_K < 8.0^m$ are marked by larger symbols.

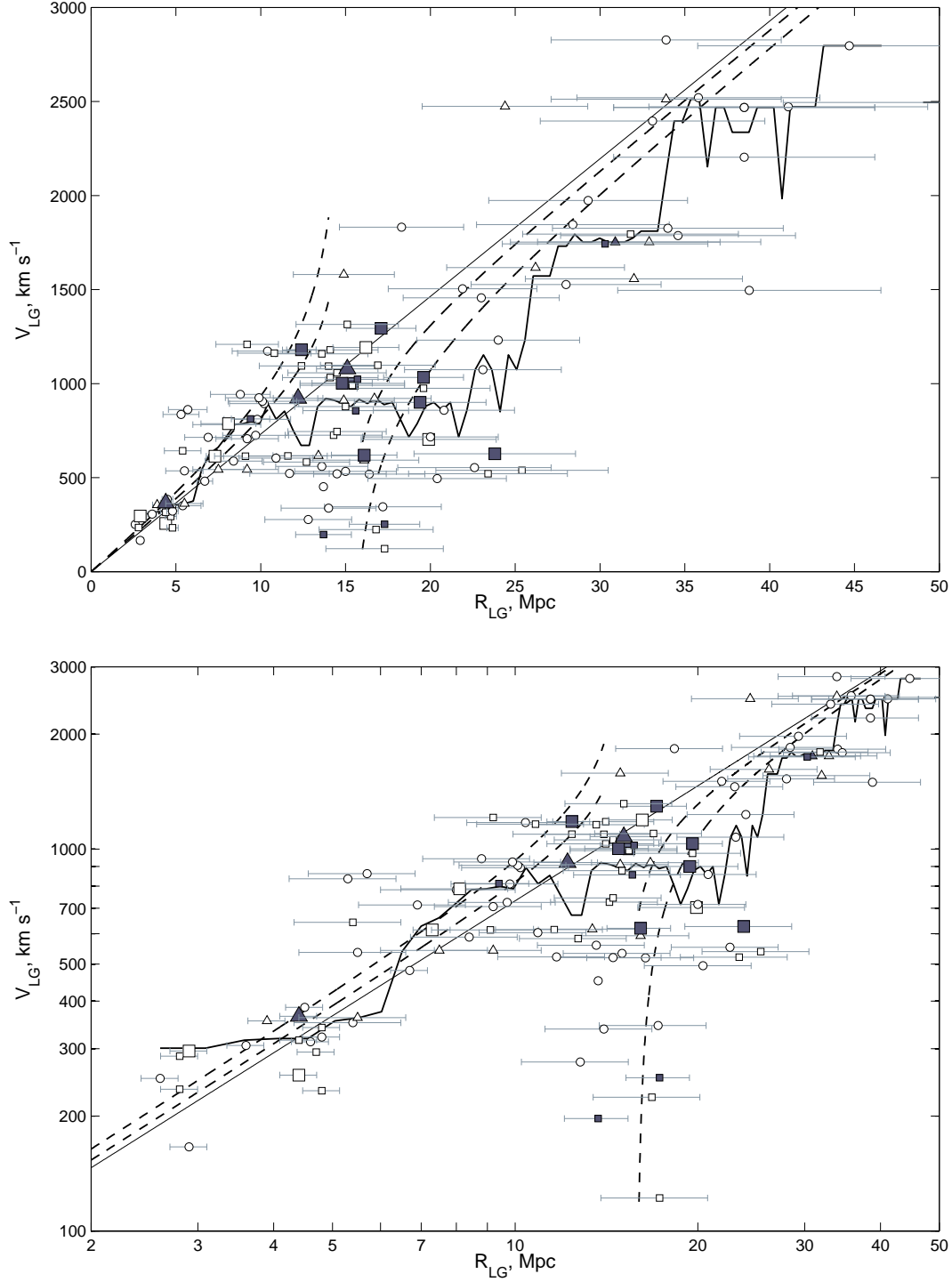


Figure 4. The velocity–distance relation for 122 galaxies in the Coma I region shown in the linear (top) and a log-log (bottom) presentations. The straight line corresponds to the unperturbed Hubble flow with the parameter $H_0 = 73 \text{ km/s/Mpc}$. The symbols, marking different galaxies are the same as in Fig.3. Distance error bars are shown. The broken line demonstrates the behavior of the running median with a window of 2 Mpc. Two dashed lines correspond to the pattern of the galaxy infall towards a point-like attractor with a mass of $0.5 \cdot 10^{14} M_\odot$ and $2.0 \cdot 10^{14} M_\odot$, located at a distance of 15 Mpc (where the line of sight passes through the attractor’s center).

Table 1. List of 36 galaxies with $V_{LG} < 600$ km/s and $D > 12$ Mpc (outside the Virgo cluster core)

Name	RA Dec (2000.0)	T	V_{LG} km/s	D Mpc	$[D]$	B_t mag	$2V_m$ km/s	V_{pec} km/s	Notes
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
NGC1400	033930.8–184117	-3	485	24.5	sbf	11.92	—	–1303	Eridanus gr
IC 2038	040854.1–555932	7	505	17.0	tf	14.98	95	–736	pair w. N1533
NGC1533	040951.8–560706	1	582	19.4	sbf	11.79	239	–834	pair w. IC2038
UGC4704	085900.3+391236	8	581	15.2	tf	15.0	96	–529	LVA
ESO497-04	090303.1–234830	8	519	14.5	tf	16.36	78	–540	
UGC4787	090734.9+331636	8	490	15.1	tf	14.6	106	–612	LVA
UGCA153	091312.1–192431	8	488	19.0	tf	15.40	96	–899	
UGC4932	091934.1+510633	8	598	18.6	tf	15.17	100	–760	N2841 gr?
DDO62	092127.5–223002	8	592	14.4	tf	14.8	103	–459	
SDSS	092609.4+334304	10	488	19.7	tf	17.8	47	–950	LVA
CGCG035-07	093444.9+062532	9	356	13.0	tf	15.22	92	–593	LVA?
ESO499-38	100350.2–263646	10	591	12.7	tf	15.68	68	–336	
KKH58	100722.7+385811	8	569	14.9	tf	15.61	72	–519	LVA?
UGC5923	104907.6+065502	7	537	16.4	tf	14.4	122	–660	Leo I gr
NGC3489	110018.6+135404	1	538	12.1	sbf	11.12	282	–345	Leo I gr
DDO97	114857.2+235016	10	453	13.7	bs	15.14	70	–547	Coma I cld
UGC6881	115444.7+200320	10	519	16.4	tf	15.9	72	–678	Coma I cld
KDG82	115539.4+313110	8	560	13.6	tf	14.84	87	–433	Coma I cld
KUG1157+31	120016.2+311330	8	593	16.1	tf	15.05	91	–582	Coma I cld
NGC4080	120451.8+265933	8	519	15.0	tf	13.7	134	–576	Coma I cld
IC 2992	120515.9+305120	9	583	12.7	tf	15.02	46	–344	Coma I cld
UGC7131	120911.8+305424	8	226	16.8	tf	15.1	102	–1000	Coma I cld
NGC4150	121033.6+302406	–1	198	13.7	sbf	12.49	—	–802	Coma I cld
KK127	121322.7+295518	9	122	17.3	tf	15.6	82	–1141	Coma I cld
UGC7267	121523.6+512060	8	550	12.9	tf	14.79	95	–392	N4157 gr?
UGC7320	121728.5+444841	8	582	14.3	tf	15.4	72	–462	N4258 gr
UGC7321	121734.0+223225	7	344	17.2	tf	14.09	188	–912	Coma I cld
IC 779	121938.7+295300	–1	196	17.3	sbf	15.22	—	–1067	Coma I cld
IC 3247	122314.0+285338	7	539	25.4	tf	15.25	137	–1315	Coma I cld
IC 3308	122517.9+264253	8	277	12.8	tf	15.41	106	–657	Coma I cld
IC 3341	122623.4+274444	9	338	14.0	tf	16.4	65	–684	Coma I cld
UGC7699	123248.0+373718	7	508	14.5	tf	13.3	162	–550	Coma I cld
UGC7774	123622.5+400019	7	553	22.6	tf	14.6	159	–1097	Coma I cld
FGC1497	124700.6+323905	8	496	23.4	tf	16.8	72	–1212	Coma I cld
UGC7990	125027.2+282110	10	495	20.4	tf	16.2	74	–994	Coma I cld
UGC12713	233814.5+304233	7	578	12.2	tf	14.81	85	–313	LOG506

Table 2. MK- groups with $V_{LG} < 3000$ km/s within $RA = [11.5, 13.0h]$, $Dec. = [+20^\circ, +40^\circ]$

Gal	RA,Dec.	V_{LG}	T	K_s	D	$[D]$
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Group N3990						
NGC3900	J114909.5+270119	1743	1	8.69	30.3	tf
UGC06791	J114923.7+264430	1795	7	11.32	31.8	tf
NGC3912	J115004.4+262844	1725	3	9.94	—	
KUG1148+258A	J115039.9+253134	1748	7	14.10	—	
Group N4062						
NGC4020	J115856.9+302449	726	6	10.75	14.3	tf
IC2984	J115907.5+304151	683	9	13.27	—	
UGC07007	J120133.2+332029	758	9	13.88	—	
NGC4062	J120403.8+315345	745	5	8.20	14.5	tf
Group N4150						
UGC07131	J120911.8+305424	224	8	13.18	16.8	tf
NGC4150	J121033.7+302406	197	−2	8.98	13.7	sbf
KK127	J121323.6+295519	122	9	13.99	17.3	tf
IC0779	J121938.8+295259	252	−1	11.79	17.3	sbf
Group N4151						
KUG1154+400	J115725.3+394552	1019	9	12.46	—	
SDSS	J120002.4+424723	1031	1	14.72	—	
SDSS	J120751.6+413347	1098	9	15.58	—	
SDSS	J120824.5+412405	955	9	14.84	—	
UGC07129	J120855.1+414427	950	2	10.56	—	
NGC4143	J120936.1+423203	1002	−2	7.85	14.8	sbf
UGC07146	J120949.2+431405	1101	7	14.00	—	
NGC4145	J121001.5+395302	1032	7	8.47	14.1	tf
NGC4151	J121032.6+392421	1001	2	7.37	15.4	tf
UGC07175	J121055.4+394524	1173	8	12.52	—	
KKH076	J121121.8+383228	1094	10	15.34	12.4	tf
UGC07207	J121219.2+370049	1057	8	12.56	14.5	tf
PGC166134	J122207.0+394442	1098	10	14.66	16.9	tf
NGC4369	J122436.2+392259	1053	1	8.91	—	

(1)	(2)	(3)	(4)	(5)	(6)	(7)
Group N4244						
KUG1207+367	J120956.5+362604	341	10	14.12	4.83	rgb
NGC4190	J121344.7+363803	235	9	12.46	2.82	rgb
UGCA276	J121457.9+361308	287	10	12.96	2.86	rgb
NGC4214	J121539.2+361937	296	9	7.90	2.94	rgb
NGC4244	J121729.7+374826	256	6	7.72	4.49	rgb
UGC07559	J122705.2+370833	233	10	11.75	4.87	rgb
UGC07599	J122828.6+371401	294	8	12.42	4.70	rgb
UGC07605	J122838.9+354303	316	10	12.50	4.43	rgb
Group N4274						
NGC4173	J121221.4+291225	1093	7	10.65	14.0	tf
PGC166125	J121319.1+282522	991	10	16.42	15.4	tf
UGC07300	J121643.3+284350	1179	10	12.64	14.1	tf
CS1008	J121651.4+290318	1100	8	15.29	—	
MAPS-NGP	J121703.4+285451	810	8	15.50	—	
NGC4245	J121736.8+293629	856	1	8.30	15.6	tf
NGC4251	J121808.3+281031	1033	-2	7.72	19.6	sbf
NGC4274	J121950.6+293652	900	2	7.02	19.4	tf
NGC4283	J122020.8+291839	1023	-5	9.03	15.7	sbf
KUG1218+310	J122035.9+304757	988	8	13.95	—	
IC3215	J122210.4+260307	975	7	12.54	19.6	tf
NGC4310	J122226.3+291231	878	3	9.67	15.0	tf
NGC4314	J122232.0+295343	959	1	7.44	—	
VV279b	J122754.0+283801	1024	10	13.13	—	
Group N4565						
NGC4494	J123124.0+254630	1294	-5	6.79	17.1	sbf
NGC4525	J123351.2+301639	1158	7	9.98	13.6	tf
NGC4562	J123534.8+255100	1315	7	11.12	15.1	tf
IC3571	J123620.1+260503	1224	10	15.37	—	
NGC4565	J123620.8+255916	1192	3	5.50	16.2	sbf
NGC4670	J124517.1+270732	1046	9	10.40	—	
KUG1247+260	J124940.6+254621	1262	8	14.10	—	
NGC4725	J125026.6+253003	1180	2	6.06	12.4	cep
KUG1249+263	J125144.4+260638	1209	10	13.83	9.2	tf
NGC4747	J125146.0+254638	1162	7	10.28	10.8	tf
MRK1338	J125310.1+251642	1075	9	12.78	—	

(1)	(2)	(3)	(4)	(5)	(6)	(7)
Group N4631/N4278						
IC2992	J120515.9+305120	583	9	12.43	12.7	tf
MAPS-NGP	J120634.5+312033	542	8	13.81	—	
NGC4136	J120917.7+295539	576	6	9.30	—	
CGCG158-058	J121707.4+303836	690	9	12.40	—	
NGC4278	J122006.8+291651	620	-5	7.21	16.1	sbf
MAPS-NGP	J122017.5+290608	673	8	15.24	—	
NGC4286	J122042.1+292045	615	7	10.81	11.6	tf
2MASX	J122116.6+290222	639	1	13.80	—	
NGC4308	J122156.9+300427	591	-5	10.61	—	
UGC07438	J122219.5+300342	669	8	13.59	—	
MAPS-NGP	J122252.7+334943	566	10	15.65	—	
UGC07457	J122309.7+292059	632	1	12.81	—	
IC3247	J122313.9+285339	539	7	12.11	25.4	tf
MAPS-NGP	J122357.4+293547	739	8	14.22	—	
NGC4393	J122551.2+273342	723	7	12.00	—	
NGC4414	J122627.1+311325	703	5	6.71	19.9	tf
NGC4448	J122815.4+283713	627	2	7.80	23.8	tf
UGC07673	J123158.1+294233	623	10	12.92	—	
NGC4559	J123557.7+275735	787	6	7.47	8.1	tf
KUG1234+299	J123714.0+293752	740	8	13.78	—	
KDG178	J124010.0+323932	774	10	15.14	—	
CG1042	J124147.1+325125	696	10	13.57	—	
NGC4627	J124159.7+323425	812	-5	8.83	9.4	sbf
NGC4631	J124208.0+323229	614	7	6.46	7.31	rgb
MCG+06-28-022	J124307.1+322926	895	8	13.21	—	
NGC4656	J124357.7+321013	643	9	10.90	5.4	tf
UGC07916	J124425.1+342312	614	10	14.57	9.1	tf
FGC1497	J124700.6+323905	521	8	15.37	23.4	tf

Table 3. MK- triplets and pairs with $V_{LG} < 3000$ km/s within $RA = [11.5^h, 13.0^h]$, $Dec. = [+20^\circ, +40^\circ]$

Gal	RA,DEC	V_{LG}	T	K_s	D	$[D]$
(1)	(2)	(3)	(4)	(5)	(6)	(7)
UGC06570	J113550.0+352007	1580	8	10.72	14.9	tf
UGC06603	J113802.1+351213	1617	7	13.01	26.2	tf
NGC3755	J113633.4+362437	1557	5	10.59	32.0	tf
HS1134+3639	J113654.7+362316	1583	9	14.88	—	
2MASX	J113901.3+312916	2705	4	11.88	—	
NGC3786	J113942.5+315433	2673	4	9.33	—	
NGC3788	J113944.7+315552	2639	3	9.34	—	
KUG1138+327	J114107.4+322537	1704	10	14.13	—	
MRK0746	J114129.9+322059	1684	9	14.17	—	
UGC06684	J114320.9+312718	1753	7	12.12	32.9	tf
UGC06684N1	J114332.7+312728	1794	9	12.79	—	
IC2957	J114537.0+311758	1752	2	11.46	30.9	tf
NGC3930	J115146.0+380054	921	5	11.18	16.7	tf
NGC3941	J115255.4+365911	922	0	7.31	12.2	sbf
UGC06955	J115829.8+380433	911	8	11.34	14.9	tf
KDG083	J115614.5+311816	617	8	11.31	13.4	tf
KUG1157+315	J120016.2+311330	593	8	12.87	16.1	tf
LSBCF573-03	J120942.6+200252	2416	10	12.54	—	
KUG1209+203	J121157.7+200140	2291	9	12.47	—	
NGC4158	J121110.2+201033	2379	4	9.73	—	
KUG1209+243	J121134.9+240144	2458	10	14.63	—	
NGC4162	J121152.5+240725	2512	4	9.35	33.9	tf
NGC4203	J121505.1+331150	1078	-1	7.40	15.1	sbf
UGC07428	J122202.5+320543	1125	8	12.83	-	
IC0777	J121923.8+281836	2495	4	11.03	51.0	tf
KUG1217+288	J121956.6+283319	2455	9	14.16	—	
KUG1218+387	J122054.9+382549	581	9	12.97	—	
KDG105	J122143.0+375914	582	10	15.07	—	

(1)	(2)	(3)	(4)	(5)	(6)	(7)
UGC07584	J122802.8+223516	543	9	13.75	9.2	tf
LSBCF573-01	J122805.0+221727	543	10	14.56	7.5	tf
NGC4793	J125440.7+285618	2474	4	8.48	24.4	tf
KISSR0148	J125445.2+285529	2336	10	15.60	—	
NGC4789A	J125405.2+270859	355	10	11.65	3.91	rgb
LSBCD575-05	J125540.5+191233	362	10	14.06	5.5	tf
NGC4826	J125643.8+214052	365	2	5.31	4.44	rgb

Table 4. Field galaxies within $RA = [11.5^h, 13.0^h]$, $Dec. = [+20^\circ, +40^\circ]$, $V_{LG} < 3000$ km/s

Galaxy	J2000	V_{LG}	T	K_s	D_{Mpc}	[D]
(1)	(2)	(3)	(4)	(5)	(6)	(7)
UGC06499	J113011.3+355208	2204	8	13.66	38.5	tf
MRK0424	J113027.7+364414	1974	9	12.82	29.3	tf
KUG1127+385	J113033.3+381427	1926	4	12.78	—	
NGC3712	J113109.1+283405	1527	8	11.69	28.0	tf
KUG1128+257	J113122.1+253005	2796	7	14.16	44.7	tf
UGC06509	J113122.7+230655	2827	7	12.49	33.9	tf
UGC06512	J113144.6+342000	1845	8	12.65	28.4	tf
UGC06517	J113202.4+364153	2472	4	11.10	41.1	tf
UGC06526	J113239.3+351942	1832	6	11.03	18.3	tf
UGC06531	J113249.0+390505	1565	6	12.45	—	
KUG1130+337	J113330.2+333026	2570	5	11.84	—	
UGC06545	J113343.4+323810	2586	3	10.65	—	
CGCG186-009	J113427.6+331044	2468	−2	11.05	—	
UGC06561	J113526.7+331810	2396	7	13.03	33.1	tf
WAS24	J113602.6+322308	2709	9	14.04	—	
UGC06599	J113742.5+240755	1496	8	14.17	38.8	tf
UGC06610	J113844.2+334821	1826	7	13.00	34.0	tf
UGC06637	J114024.9+282226	1787	9	11.72	34.6	tf
MRK0426	J114049.1+351212	1504	7	12.29	21.9	tf
NGC3813	J114118.7+363248	1456	4	8.86	23.0	tf
UGC06658	J114202.4+320003	1434	6	12.59	—	
MRK0429	J114626.0+345109	1365	5	11.43	—	
UGC06782	J114857.2+235016	452	10	12.67	13.7	bs
UGC06792	J114923.4+394619	858	7	11.95	20.8	tf
UGC06817	J115053.0+385249	251	10	10.98	2.64	rgb
MRK0641	J115227.4+345340	2196	9	13.95	—	
UGC6881	J115444.7+200320	519	10	14.50	16.4	tf
KDG82	J115539.4+313110	560	8	12.41	13.6	tf
BTS076	J115844.1+273506	451	10	14.05	—	
NGC4032	J120032.8+200426	1173	7	10.37	10.4	tf
2MASX	J120105.9+285943	2910	3	13.44	—	
BTS089	J120147.0+282138	799	10	14.06	—	
KUG1201+292	J120404.7+285853	874	9	12.67	—	
NGC4080	J120451.8+265933	533	8	10.78	15.0	tf
KUG1202+286	J120523.3+282156	527	8	13.15	—	
DDO109	J120723.6+394846	894	10	12.72	10.2	tf
UGC07125	J120842.3+364810	1074	8	12.64	23.1	tf
MAPS-NGP	J120921.2+251203	719	9	15.10	—	
UGC07143	J120946.7+250134	2520	4	11.70	35.8	tf
KUG1209+255	J121206.5+251833	2542	10	15.13	—	

(1)	(2)	(3)	(4)	(5)	(6)	(7)
NGC4163	J121209.2+361009	166	10	12.85	2.96	rgb
UGC07236	J121349.1+241553	887	10	13.81	—	
UGC07257	J121503.0+355731	943	8	12.25	8.8	tf
NGC4204	J121514.4+203931	782	7	11.83	8.	txt
UGC07321	J121734.0+223223	345	7	10.65	17.2	tf
NGC4275	J121952.6+273715	2276	5	10.18	—	
UGC07427	J122155.0+350305	725	10	14.09	9.7	tf
NGC4359	J122411.1+313118	1231	5	10.80	24.0	tf
UGC07485	J122422.2+210936	847	9	13.25	—	
IC3308	J122518.2+264254	277	8	13.00	12.8	tf
KK144	J122527.9+282857	453	10	14.02	—	
NGC4395	J122548.9+333248	313	9	9.97	4.67	rgb
IC3341	J122623.4+274444	338	9	11.57	14.0	tf
NGC4455	J122844.1+224921	588	7	10.63	8.4	tf
UGC07678	J123200.4+394955	714	9	12.47	6.9	tf
UGC07699	J123248.0+373718	520	7	11.15	14.5	tf
UGC07697	J123251.6+201101	2468	5	12.93	38.5	tf
UGC07698	J123254.4+313228	322	10	10.63	4.85	rgb
NGC4509	J123306.8+320530	906	9	12.70	10.1	tf
KUG1230+336	J123324.9+332103	836	10	13.57	5.3	tf
UGC07719	J123400.6+390110	707	8	12.33	9.2	tf
NGC4534	J123405.4+353108	810	8	11.21	9.8	tf
MAPS-NGP	J123521.0+273347	1470	9	14.59	—	
UGC7774	J123622.5+400019	553	7	12.53	22.6	tf
MAPS-NGP	J123649.4+333648	522	8	14.48	11.7	tf
UGCA290	J123721.8+384438	481	10	13.33	6.70	rgb
UGCA292	J123840.1+324601	306	10	13.63	3.62	rgb
UGC07816	J123856.9+380525	2252	1	13.32	—	
PGC166140	J124131.1+394847	669	10	14.69	—	
IC3687	J124215.1+383007	385	10	11.30	4.57	rgb
BTS150	J124312.8+352447	1819	10	15.00	—	
UGCA294	J124438.3+282819	925	9	12.46	9.9	tf
IC3740	J124530.6+204857	2602	4	12.81	—	
UGCA298	J124655.4+263351	774	9	12.42	—	
DDO147	J124659.8+362835	351	10	12.69	5.4	tf
UGC07990	J125027.2+282110	495	10	14.59	20.4	tf
IC3840	J125146.1+214407	536	10	14.38	5.5	tf
UGC08011	J125221.1+213746	716	10	15.49	20.0	tf
UGC08030	J125429.4+261818	604	10	15.61	10.9	tf
BTS160	J125526.9+325905	906	7	15.20	—	
UGCA309	J125617.8+343917	747	10	13.11	—	
PGC166151	J125901.0+352852	723	7	14.77	—	
NGC4861	J125902.3+345134	862	10	11.76	5.7	tf

Table 5. The mean properties of the MK- groups

Group	N_v	V_{LG}	σ_v	R_h	$\lg L_K$	$\lg M_{vir}$	$\lg M/L$	N_D	DM	σ_{DM}
N3900	4	1745	30	227 291	10.74 10.96	11.31 11.42	0.57 0.46	2	32.46	0.10
N4062	4	736	33	175 247	10.08 10.38	11.92 12.07	1.84 1.69	2	30.80	0.02
N4150	4	211	56	56 310	8.68 10.17	11.61 12.35	2.93 2.18	4	31.05	0.21
N4151	14	1031	69	348 363	11.03 11.07	12.56 12.58	1.53 1.51	6	30.83	0.21
N4244	8	291	38	76 73	9.71 9.67	11.60 11.58	1.89 1.91	8	27.95	0.51
N4274	14	990	102	256 303	11.22 11.36	12.70 12.77	1.48 1.41	9	31.06	0.29
N4565	11	1191	83	301 255	11.83 11.69	12.98 12.91	1.15 1.22	6	30.73	0.36
N4631	28	635	90	243 333	11.12 11.40	12.98 13.12	1.86 1.72	11	30.41	1.31

